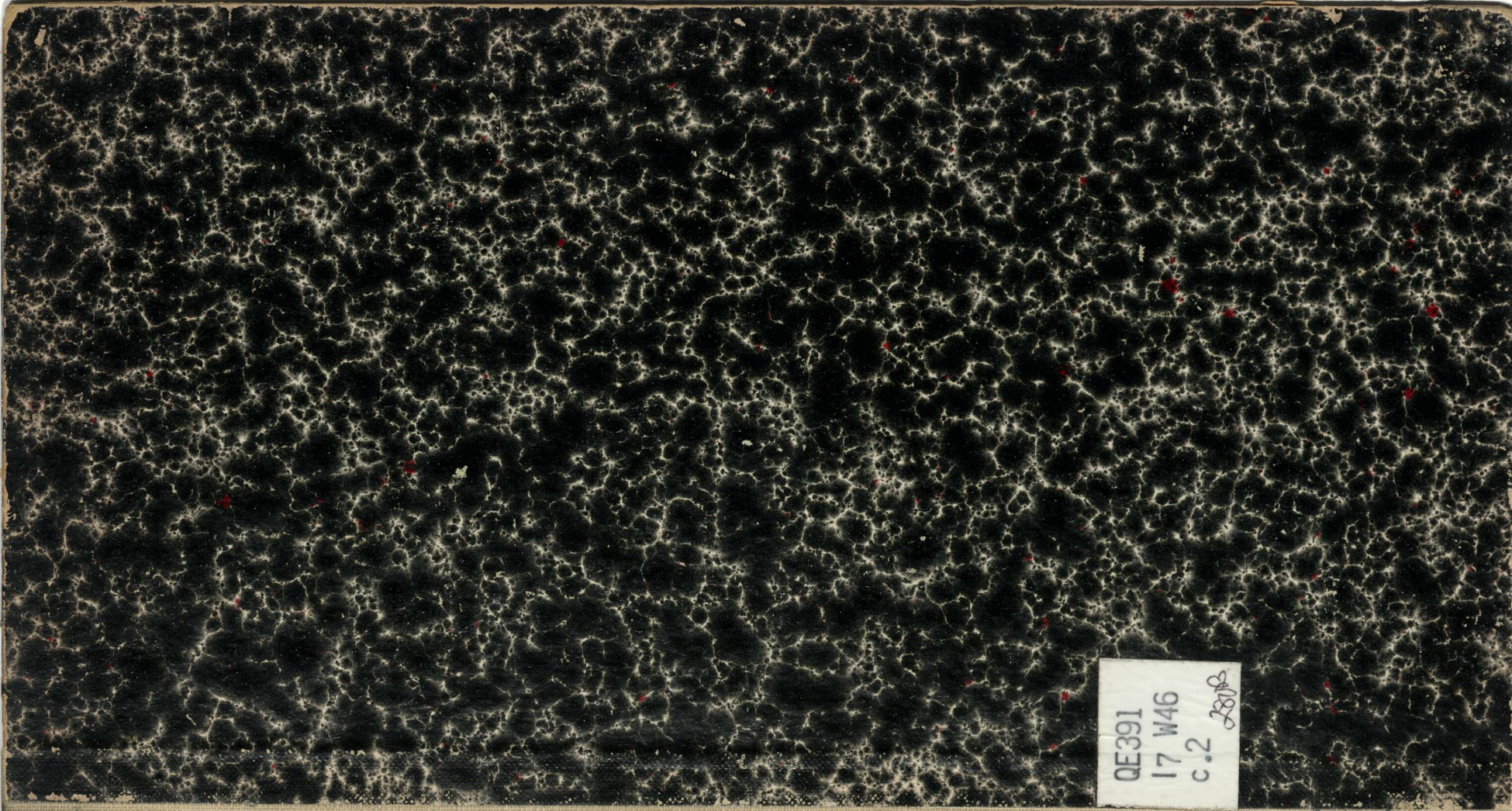

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IRON ORES

OF THE

Great Seam Coal Region.

By COLONEL CHARLES WHITTLESEY.

We have as yet received little information from the Geological Reports in reference to the "Great Vein," or more properly the "Great Seam," coal region of Perry, Hocking, and Athens counties. Although it is eight years since the survey was commenced and three years since it was supposed to be closed, there are several other counties rich in minerals where there is the same deficiency. The people of these counties are now suffering the legitimate consequences of that singular arrangement, made in 1869, between the Governor of Ohio and the Chief Geologist, by which the latter was allowed to retain his professorship at Columbia College, New York, requiring his presence there half the year, and draw full pay from the State.

This survey of necessity became an adjunct to Columbia College, where its headquarters were; and an excellent field for the benefit of her young men.

Beguiled by magnificent promises, the Legislature has made appropriations from time to time, reputed to amount, for field work and reports, to $250,000, for a purpose the prime object of which is not yet attained. The economical geology is neither specific, reliable, or complete.

The consequences are that the practical work is still so deficient that it must soon be done over again, in order to meet the requirement of the times. In the meantime we must resort to the labors of such mining engineers and geologists as can be found. Among these are the following: A report by the late Professor W. W. Mather, made in 1857, to the "Central Ohio Coal Company." In this he predicts the future success of iron making there, states that the supply of ore is large and the quality equal to that of the Hanging Rock region.

Professor E. B. Andrews, of the geological survey, has given several detached notices in the reports, and in pamphlets, relating to particular localities. Professor M. C. Read, also of the survey, has done some work in this district. Neither of these gentlemen are responsible for the want of more thorough official work, in this and other important mineral districts. In 1874, Professor T. Sterry Hunt, of the survey of Canada, made a very full report on the entire Nelsonville coal field, which was accompanied by a valuable map by Col. J. H. Riley, C. E. of the Shawnee Railway. Since 1871 I have published three pamphlets relating to this interesting region, some portions of which will be repeated in this paper. During the past winter, James Nichols, a mining engineer of Philadelphia, has made two very elaborate profiles through the Great Seam area, and Mr. Andrew Roy, the State Mine Inspector, has contributed notices of it in his annual reports. A special survey is required of this region, to be made at once by a competent mining engineer.

What is called the "Great Seam" region occupies a space of about 100 square miles, in the townships of Ward, Salt Lick, Trimble, Monroe, and Pleasant.

Geologically it is not different from the Nelsonville seam, but its thickness is nearly doubled, rising from six to eight, nine, eleven, and twelve feet, with an average of nine, thinning out on the north around New Lexington to five feet. As the seam thickens its character changes somewhat, becomes more dry burning, especially on the upper half, and using the face of the coal, works readily in stack furnaces in a raw state. The first experiment was made by Mr. S. Baird, of Columbus, in

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1870. In consonance with the increased thickness and change in quality of the coal, the seams of iron ore, increase in thickness and value over the same space.

The country is a labyrinth of sharp hills, with narrow valleys, the local elevations being 200 to 300 feet, or 400 to 500 feet above Lake Erie. Sunday creek on the east, Snow fork in the center, and Monday creek on the west, with a multitude of branches, have excavated their channels down through the Great Seam, over most of the territory. The general dip of the Seam is about South, 70 deg. east, at the rate of about 30 feet to the mile, and very regular.

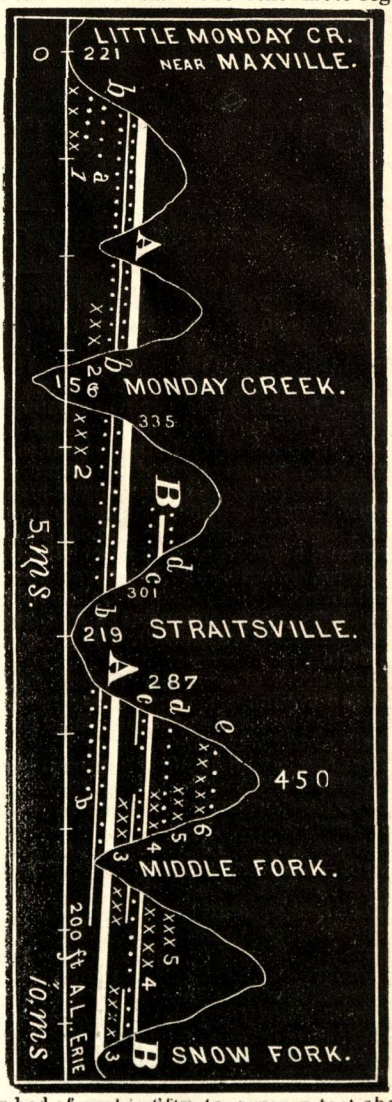
These conditions present a natural line of out-crop many hundred miles in length, near the base of the hills, twenty to fifty feet above drainage. The other strata of coal, iron ore, and limestone are conformable to the Great Seam, rising to the tops of the hills. I know of no coal-field where the mineral beds can be mined with so much facility, or where there is such wonderful concentration in so small a space. At present it is reached by two railways, one from the north from Sandusky through Newark to Shawnee, the other from Columbus by a branch from Logan to Straitsville, known as the Hocking Valley Railroad. There are at Straitsville six large coal companies in operation, the first mines being opened in 1870, in which the seam averages ten feet in thickness. At Shawnee there are five coal companies and two furnaces, the coal ranging from six to eleven feet.

I here give a general profile of the strata from Little Monday creek to Snow fork, through Straitsville, on the line of dip. It embraces many of the mineral beds to the north and east of that place, at Shawnee and on Sunday creek, but to exhibit them properly requires at least two more parallel profiles. The Great Seam is the most persistent stratum of the series, in fact nearly the only one that can be traced through the district with certainty. Other beds of coal, of which there are in places four, and beds of limestone, sandstone, shale and iron ore are frequently wanting. The supposed identity of strata in Ohio seems to me to have been carried altogether too far. More detailed and more accurate work on the side of physical geology, with less reliance upon fossils, and a closer comparison of profiles, I think will demonstrate this. Profiles made even at short distances apart, if brought into exact relation by levels, very frequently show different beds, and the absence of beds, which demonstrates a want of identity.

My object in this paper, however, is principally to show the number and probable value of the seams of iron ore in the Great Seam district. The profile shows only such beds as I have examined in place. Only the Great Seam itself, A A, is so persistent that it may be relied upon everywhere, and therefore forms the best plane or horizon of reference for the other strata The next most regular bed of coal is fifty to seventy feet above it, known as the "Bayley's Run" coal, shown by the letter B. Next below the Great Seam, at a distance varying from twenty-five to thirty feet, is a constant companion

PROFILE OF THE STRATA AT STRAITSVILLE.

[Direction south 70 deg. east. Scale, one-half inch to the mile.]



of A, but of quite variable thickness and quality. Between A and B is a seam sometimes of workable thickness, called the "Middle," or "Norris coal," but which is frequently wanting. It lies beneath B, at about the same distance as the other thin bed below A. The upper, or Bayley's Run coal, and its tender, the "Middle coal," are so much alike and so near together that it is not always practicable to separate them without close examination. Both have the aspect of coking coals, and thus may play an important part in the manufacture of iron. Coal from the Bayley's Run Seam B has lately been coked at the XX furnace, at Shawnee, to be tried in the furnace with the raw coal of the Great Seam, the lower part of which is liable to clog in the stack. In large stacks coke will be a necessity.

The base of profile is 200 feet above Lake Erie. Figures placed at right angles to the profile represent elevations above Lake Erie.

Hackled or cross lines represent beds of limestone, numbered thus: 1, 2, 3, 4, 5, 6. Small letters, a, b, c, d, e, beds of iron ore.

Capital letters, A and B, show the position of the Great Seam, and the Bayley's Run Seam.

BEDS OF LIMEROCK.

No. 1—Maxville limestone, lying at the base of the coal series, in the horizon of the conglomerate. It is a valuable flux used at the Baird and Gore furnaces, on which are nodules of iron ore.

No. 2—Putnam Hill limestone, according to Professor Andrews eighty to ninety feet below the Great Seam; color, blue.

No. 3—An impure limestone, twenty to thirty feet above the Great Seam; probably hydraulic; frequently wanting, or found only in large blocks and nodules.

No. 4—A stratum within twenty feet above coal seam B, and by no means persistent.

No. 5—A limerock quite universal, about sixty feet above A; color, blue; used for flux at the Shawnee furnaces.

No. 6—This is often wanting, but occasionally seen high on the hills—Mr. Nichols and Professor Andrews regard it as the Cambridge lime rock of Muskingum county. Near it, apparently on the top, is a band of iron ore, well filled with fossils, both ore and lime rock much decomposed near the out-crop. Between Snow Fork and Sandy creek it is more regular. The Ames limestone of Guernsey and Monroe county is eighty or ninety feet higher.

DIP OF THE STRATA.

With the assistance of Colonel Riley, engineer of the Newark, Somerset & Shawnee Railroad, and his assistants, Mr. Carey Wilson, Mr. George S. Lester, of the Atlantic & Lake Erie Road, and W. H. Jennings, of the Hocking Valley Road, I have the elevation of coal seam A at numerous points. By constructing triangles upon our largest maps connecting these points, I have determined the general inclination of this seam on the waters of Monday and Sunday creeks. As the other strata are conformable these results are an exponent of the dip of all the beds.

The distances extend (5) five to (8) eight miles across the formations, which is enough to do away with the effect of local undulations, of which there are few. It is very rare to find a bed of coal so regular. After leveling for its position, I have generally found it within five feet of its calculated place. Beginning at the south and proceeding northward the results are shown in the following table. At Straitsville it is locally thirty-six to forty-two feet per mile:

DIP OF COAL SEAM A.

No of triangle.	direction of dip.	rate per mile.
1	South 79 deg. East	36½ feet
2	South 78 deg. East	32 feet
3	South 77 deg. East	25¾ feet
4	South 74 deg. East	32 6-10 feet
5	South 62½ deg. East	30 feet
6	South 60 deg. East	30 feet
7	South 67 deg. East	24 feet

IRON ORES OF THE REGION.

Since the coal is practically inexhaustible, and well adapted to making iron, and there is an abundance of flux, if the ores are sufficient this must soon become a great iron center. Some difficulty is experienced in securing water in very dry seasons, but a series of cisterns, wells, and pools will remove this objection, at a reasonable expense. The developments of the past year have very materially improved the prospects for a permanent supply of native ores. There are three to five seams in nearly every hill, most of them of good quality. Professor Mather says they will last for at least one generation. Those lying below the Great Seam are a continuation northward of the well known Hanging Rock series. For about twenty years they have been mined for the charcoal furnace at Logan, the metal of which is fully equal to Hanging Rock. For some years these ores have been taken to the stone coal furnaces at Columbus and Zanesville. It has now been discovered that it is not very good policy to transport ore and coal away from their nativity, in order to make iron cheaper.

There are two beds below the Maxville limstone that have been wrought to some extent. The nodules that lie on the Maxville are also of some value, but not very reliable as to quantity. Professor Andrews

refers to a heavy seam, about forty feet above this lime rock (a of the profile), as a valuable deposit. The Baird furnace is now opening it. It appears to be thick enough to drift, and of an excellent quality.

Above the Maxville limestone, and from thirty to thirty-five feet below coal seam A, is a group or family of ore seams, from which most of the mineral hitherto mined in this region has been taken.

It is very probable that all the ore beds that accompany the Great Seam are in their original state, in the form of carbonates. This group has three beds within a space of eight to twelve feet, next beneath the lower coal seam. One is a soft yellow ochery ore, very easily melted four to eight inches thick, but nowhere as yet followed into solid cover. The other two are known as the "red" and the "black red," sometimes reaching a thickness of sixteen inches, with an average of seven to ten inches, and an oolitic structure, but in this respect not uniform. Two of them are sometimes uncovered by one stripping. In places one of them might be drifted for, but this is an exception. The hills and ridges are so numerous that the development of outcrop is very large, and those accessible by stripping are good for a quarter of a century. The Baird furnace, the one at Gore, another going up a couple of miles west, and those contemplated on Monday creek, will rely principally upon the ores of this group. Two miles west of Straitsville a bed has recently been uncovered, in this horizon apparently of great thickness, but as yet not followed into solid ground.

Next below the Great Seam is a series of nodules, not much thought of at present, but which will eventually be mined.

ORES ABOVE THE GREAT SEAM.

By some the number of seams above A is placed at ten, but as yet only one is thoroughly developed. I shall notice them in the ascending order:

First—A very regular, and as it appears, a very fine ore, four to seven inches thick (c of profile) between the two upper beds of coal at B.

Second—The Shawnee seam now worked at Iron Point for the furnaces at Shawnee.

Its outcrop is visible over a large territory, but only at Shawnee has it been mined under cover. At the end of a drift 120 feet in length it is a solid gray, fine grained carbonate, averaging two feet in thickness. The roof is yellow shale, twenty to thirty feet to the top of the hill; the floor fire clay. Around the edges where it is stripped, having a varying thickness of one to four feet, it is wholly changed in color, texture, and chemical ingredients. In some places it is an ochery hydrate, in others a dark slaty ore, somewhat resembling black band, with gray unaltered carbonate at the center. It comes out in blocks, easily handled, and on the calcining pile becomes a porous reddish brown oxide. In the heaps it melts into a black cinder, which the magnet attracts. Two and a half tons in its raw state produce a ton of foundry iron. Its elevation above the Great Seam at Shawnee is 110 feet. At other places it varies from 100 to 120, but within those limits signs of it are generally found. About 160 feet above A, in nearly all the hills, there is a blossom of what appears to be a regular seam of ore, associated with lime rock, the two represented by 6 and e on the profile.

This limerock extends over a wide district, where there are ores on or near it. I have seen the decomposed outcrop eight inches thick, but have not seen it under cover. The other seams within range of the profile are at least three, but as yet undeveloped. Even on the same horizon, it must not be expected that the same seams will be of the same quality or thickness. At the Ogden furnace, on Snow Fork, the prominent and apparently the best seam, ten to eighteen inches thick, is reputed to lie below coal B.

But a country having numerous beds of ore of available thickness may be relied upon to make up in one horizon what is wanting in another.

The estimate of Professor Mather is that pig metal can be made for $11 per ton. Foundry iron has been made at four furnaces during the past winter at prices varying from $12 to $13 per ton. Even at present low prices it is evident that these establishments have been profitable.

CLEVELAND, O., April 20th, 1877.

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